SUMMARY
of the Seventeenth Meeting of the Providers' Forum
held in conjunction with the Eleventh Meeting of the International Committee on Global Navigation Satellite Systems (ICG)

6 and 10 November 2016
Sochi, Russian Federation

The Seventeenth Meeting of the Providers' Forum, co-chaired by the Russian Federation and the United States, was held in conjunction with the Eleventh Meeting of the International Committee on Global Navigation Satellite Systems (ICG), on the 6th and 10th of November 2016, in Sochi, Russian Federation. The meeting agenda is attached as an annex to this report. China, India, Japan, the Russian Federation, the United States and the European Union were represented at the meeting.

Open Service Information Dissemination

The following presentations were provided:

- **Space Service Volume**

  The Russian Federation presented on Space Service Volume (SSV) and the practical results of using Global Navigation Satellite Systems for positioning, navigation and timing of Russian Geosynchronous Orbit (GEO) satellites for 10 years. The presentation discussed the benefits of using GNSS for high orbiting satellites and signal geometry. It also reviewed results on visibility, geometry and positioning accuracy. The knowledge and experience so far has revealed prospects for onboard autonomous GNSS navigation technology for GEO and highly elliptical orbit (HEO) satellites, and identified new benefits for many high-orbit missions.

  The United States presented an update on the progress in developing and utilizing the GNSS SSV. It was noted that the Global Positioning System (GPS)/GNSS systems, in general, are being utilized for three purposes: Real time on board navigation; Earth Science, including atmospheric and ionospheric science and geodesy; and attitude determination, in particular for the International Space Station. The presentation

discussed the significant benefit of SSV cooperation and specifications for high-altitude space user performance when moving from GPS-only usage to multi-GNSS usage, which increases the signal visibility of a main-lobe-only system from sporadic to nearly continuous. The United States expressed appreciation for the significant contributions presented by the Russian Federation on SSV progress, and to the ICG Working Group B on the substantial work they have accomplished over the past year. The Providers' Forum noted that Japan will host the second International Space Exploration Forum in 2017. In addition to the ICG-12 there may be a natural synergy between these events with respect to discussion on SSV.

- **GPS Time Offset Issue**

  The United States presented an update on the January 2016 Coordinated Universal Time (UTC) Time Offset anomaly to GPS. It was noted that software updates were implemented to resolve the core upload issue, with future software updates planned to further reduce the risk of a reoccurrence. The Institute of Navigation paper, posted at http://gps.gov/systems/gps/performance, discusses the impacts to receivers. It was explained that this software issue is not unique to GPS. Monitoring systems can reduce the impact on users.

- **Space Debris**

  The Russian Federation presented on Space Debris in GNSS Operational Orbits. The presentation discussed the population and density of catalogued objects in GNSS orbits, and the results of an analysis of long-term orbital evolution of GNSS satellites, specifically looking at the intersection of orbits of different GNSS satellites. GLONASS mitigation measures were described and compliance with the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and Interagency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines was noted. A recommendation was made for Providers to monitor discussions related to debris mitigation in medium earth orbit (MEO) by linking with their experts working in these international organizations.

- **iGMAS Update**

  China presented an update on their International GNSS Monitoring and Assessment System (iGMAS), and explained that the objectives are to establish a global tracking network and to monitor operational status and key indicators for all GNSS. The system has an open architecture and other international monitoring centers and GNSS tracking stations are invited to participate. Most of the system construction has been completed,

with 18 tracking stations around the world, and routine service is now underway. Information distribution of the system is now available in Chinese and English through a website (http://124.205.50.178) and an application (APP) that can be downloaded for mobile use.

- **Adjacent Band Compatibility**

  The United States presented an update on the Adjacent Band Compatibility (ABC) study that resulted from a proposal by a private company in 2011 to broadcast terrestrial mobile telecommunication signals adjacent to the GNSS L1 frequency band in the United States. The testing in 2011 showed impact to virtually all GPS receivers. The goal of the ABC study is to determine the power levels that can be tolerated in the adjacent radiofrequency bands. Radiated testing in an anechoic chamber was completed in 2016, as well as lab testing and antenna characterization. Eighty GPS/GNSS receivers were tested, which included the following six categories: general aviation (non certified), general location/navigation, high precision and networks, timing, space based, and cellular. An overview of the preliminary results was presented.

Service Performance Monitoring

The United States provided a presentation on the GPS Service Performance Standard Assessment. The 2013 GPS Performance Standard Report has been published, and is available at the following website: http://www.gps.gov/systems/gps/performance/. The 2014 and 2015 reports are being finalized and will be available in 2017. These reports measure GPS performance against the GPS Standard Positioning Service Performance Standard parameters. Other GNSS Providers are encouraged to make available similar reports for their systems.

Multi-GNSS Demonstration Project in the Asia/Oceania Region

Japan provided an update on the multi-GNSS demonstration project in the Asia/Oceania region. There are three components to the project: establish monitoring networks, application demonstrations, and regional workshops. Currently there are 99 Multi-GNSS Monitoring Network (MGM-Net) stations in operation. Multi-GNSS Asia (MGA) is an organization to promote the project with 53 participating organizations. The 8th MGA Conference will be held 14-16 November 2016 in Manila, Philippines. MGA will be discussing possible updates to its work plan enhancing the linkage with ICG.

ICG Information Centres: Regional Centres for Space Science and Technology Education (affiliated to the United Nations)

The ICG Secretariat noted that the African Regional Centre for Space Science and Technology Education – in French Language (CRASTE-LF) in Rabat, Morocco will host a training course on GPS data processing for studies of the ionosphere on 16 – 21 January 2017. Experts from the United States and other GNSS Providers are invited to participate in this training.

Other Matters:

- **Terms of Reference of the Providers Forum**

  The Providers agreed to the schedule through 2019, and it was noted that co-chairs will be provided by the following members: Japan and China will co-chair the 2018 Providers' Forum meeting, and China and India will co-chair the 2019 meeting. The Terms of Reference will be modified accordingly.

- **Membership and Participation in ICG**

  The request from January 2016 for Observer Status by Resilient Navigation and Timing (RNT) Foundation was noted and it was suggested that the RNT Foundation be invited to present their purpose and reason for interest in becoming an observer to the ICG. It was further noted that a participant from the RNT Foundation was not available to attend the ICG-11 meeting.

  The Providers noted the Expression of an Interest from the Korean Aerospace Research Institute (KARI) to participate in the ICG-11 meeting as an invited observer, and concurred with the request.

  The Providers' Forum reviewed the recommendations from the four working groups and agreed that they should be adopted by the ICG at its last plenary session. The Providers' Forum also adopted the summary of its 17th meeting.

Annex

SEVENTEENTH MEETING OF THE PROVIDERS' FORUM

Sochi, Russian Federation

6 and 10 November 2016

AGENDA

(*based on the Workplan of the Providers' Forum*[1] *and the summary of the Sixteenth Meeting of the Providers' Forum)*

Co-Chair: Sergey KARUTIN, Russian Federation

Co-Chair: Kenneth HODGKINS, United States of America

Sunday, 6 November 2016

12:00 – 18:00 On-site Registration

13:00 – 15:40 First Session of Providers' Forum

Attended by only the Providers. *The primary purpose is: (i) to discuss the agenda and meeting procedures for ICG-11 and the 17th Meeting of Providers' Forum; (ii) to develop response or suggest amendments to the Working Groups draft recommendations; (iii) to address any other matters; (iv) to compose a temporary drafting group on the preparation of the Providers' Forum report*

Opening Remarks

Review of Providers' Forum Agenda

Open service information dissemination

- Space Service Volume and Russian GEO satellites PNT, *Alexander GRECHKOSEEV, Maxim SANZHAROV and Dmitry MARARESKUL, Joint Stock Company "Academician M.F. Reshetnev "Information Satellite Systems"*
- Space Service Volume Update, *Frank BAUER, United States of America*
- Update on GPS Time Offset Issue, *Frank CLARK, United States of America*
- Space debris in GNSS operational orbits, *Igor USOVIK, TsNIImash*

[1] *ICG/PF/WP/SEP2009, amended (available at the ICG Information Portal at http://www.unoosa.org/pdf/icg/2009/icg-4/ICG.PF.WP.SEP2009.pdf)*

- Update on iGMAS, *Wenhai JIAO, Xurong Dong, Hanrong SUN, Shuli SONG, China Satellite Navigation Project Center*
- U.S. Adjacent Band Compatibility Update, *Karen VAN DYKE, United States of America*

Service performance monitoring

- Service Performance Standard Assessment, *Frank CLARK, United States of America*

Spectrum protection: interference detection and mitigation

Multi-GNSS demonstration project in the Asia/Oceania region

- The status update on Multi-GNSS Asia, *Satoshi KOGURE, National Space Policy Secretariat, Cabinet Office, Japan*

ICG Information Centres: Regional Centres for Space Science and Technology Education (affiliated to the United Nations)

- Activities to be carried out in 2017, *Sharafat GADIMOVA, ICG Executive Secretariat, Office for Outer Space Affairs*

Comments on the Agenda of the Eleventh Meeting of the ICG

Other Matters:

- Terms of Reference of the Providers' Forum
- Membership of the ICG: *The request for Observer Status by Resilient Navigation & Timing Foundation*
- Expression of an interest (to participate in the ICG-11 meeting as an invited observer): *Korean Aerospace Research Institute (KARI), Korea*

15:40 – 16:00 *Coffee Break*

16:00 – 17:00 **Meeting with the Working Groups Co-Chairs and Working Groups reports**

Attended by only the Providers and the co-chairs of the Working Group. *The primary purpose is: (i) to identify issues for discussion in the working groups; and (ii) to consider their reports on the status of the implementation of the agreed recommendations from the previous ICG meetings.*

17:00 **Adjourn**

Thursday, 10 November 2016

16:00 – 18:00 **Second Session of Providers' Forum**

Attended by only the Providers and the co-chairs of the Working Group. *The primary purpose is: (i) to discuss any draft recommendations to the ICG from the working groups; (ii) to develop response or suggest amendments to the draft recommendations if needed.*

Adoption of the Providers' Forum report

Concluding remarks